Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	}	
	}	
Revision of Part 15 of the Commissions	}	
Rules Regarding Ultra-Wideband	}	ET Docket No. 98-153
Transmission Systems	}	

Reply Comments of ANRO Engineering, Inc.

Preliminary Comments:

Private industry has been attempting to receive Part 15 approval for the radiation of low-power Ultra-Wideband (UWB) transmissions for short-range radar and communication applications since the late 1970's. The initial efforts were pursued by the former Sperry Corporation and later by ANRO Engineering, Inc., having direct contact with FCC personnel during the 1980's. These efforts were unsuccessful in spite of voluminous data presented to the FCC with calculations similar to that offered recently by NTIA in reports addressing the subject of interference from UWB transmissions. One of the government organizations that offered the most objections to the use of UWB signals was the FAA. We found this to be particularly surprising because UWB runway safety intersection control experiments were conducted over a six-month period by personnel of the former Sperry Research Center, Sudbury, MA, at the Logan International Airport in Boston. Working in cooperation with Massport engineers, who were also concerned with possible interference of these new transmissions, it was demonstrated, conclusively, that the equipment did not interfere with guidance, safety, or communications equipment located at Logan Airport. This work was described in an invited and published article in the Proceeding of the IEEE. *

It was only as a result of recent political pressure asserted by Time Domain Inc. and others, that the subject of using low-cost UWB techniques for the benefit of mankind and industry is being revisited 25 years later. The sensors being suggested for use today are far more sophisticated than, for example, the short-range radar originally proposed for intersection control at airports successfully demonstrated in 1977. In addition, there are a number of sensors being offered for the detection of buried mines, and pipes. There is also a separate class of sensors for very short-range obstacle detection and identification via time-domain reflectometry such as finding studs in a wall, or the non-invasive detection of breast cancer tumors. Somewhat longer-range sensors are being used to find bridge faults while longer-range radar sensors are being manufactured for intrusion detection. Finally, there is a special class of low-cost communications transceivers, which has received increasing attention in industry.

ANRO suggests that, based on experience and report data, the new modified Part 15 regulation

for UWB transmissions should be issued in three parts. The first part described below for detecting buried objects should be issued forthwith. The second part regarding short-range radar should follow directly in an effort to improve airport safety via runway-taxiway intersection control for smaller airports where lives have already been lost. Communication transceivers, however, require more study and field evaluation.

The recommendations are presented in more detail below and are based, in part, on the data published in the NTIA reports:

- The detection of buried mines and pipes offers no potential problem for interference against other systems provided the radiating structure operates only when placed on the earth's surface before operation. This should be one of the first Part 15 UWB regulations issued. Limitations on peak and average power and PRF are discussed below.

- Next, the short-range radar or time domain reflectometer regulation should be issued. Here, limitations on peak and average power, the prf, and the ratio of the peak to average power and even the range between the sensor and fixed radar/communication facilities can be specified.

- Finally, there is issuance of Part 15 regulations for UWB communications. Here, the concern stated in the reports is the "floor" of average power that results from a large number of hand-held communication devices being employed. We agree that for devices above 3.0 GHz with certain prf and power limitations as indicated by MSSI in their submission to the FCC dated March 16, 2001, there is less likely to be an interference problem. Certainly, for transceivers below 3.0 GHz, more test and evaluation should be performed before a revised Part 15 UWB regulation can be issued assuring safety against interference.

<u>Specific Recommendations for Parameter Limitations for Certain Part 15 Applications:</u>

ANRO recommends that UWB transmitters for radar and time domain reflectometer application be subject to the following limitations:

- Peak Power: 1 kW max;
- Peak to average power: 60 dB max;
- Spectrum: spectral content 2 GHz and above, 10 dB down at 2 GHz;
- Maximum PRF: 10 kHz;
- PRF jitter rate 2.5 percent or greater.

Another parameter that the FCC may wish to specify, and this is based upon field tests, is the distance between the UWB radar source and certain narrow band equipment being operated in its vicinity. If the sensor is facing in the direction of a fixed installation the parameter $2E/n_o$, where E is the total energy in the received pulse and n_o is the noise power in the receiver channel at the fixed installation should follow the inequality:

$$2E < n_o$$

This is a conservative estimate since it assumes that the 1-10 MHz bandwidth receiver is a matched filter to the UWB transmission, which of course is not the case. This also results in less than an 8-dB tangential sensitivity for interference detection.

*C. L. Bennett, G. F. Ross, “Time Domain Electromagnetics and Its Applications”, Invited Paper, Proceedings of the IEEE, Vol. 66, No. 3, pp. 299-318, March 1978